REMARKS

Claims 1, 3-4, 11-12, and 15-16 have been rejected under 35 U.S.C. §112, second paragraph. The claims have been amended to obviate the Examiner's rejection.

Claims 1, 11-12, and 15-16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over either Hashimoto, U.S. Patent No. 5,873,770 or Wood, British Pat. No. 227277. Claim 3 has been rejected under 35 U.S.C. §103(a) as being unpatentable over either Hashimoto '770 or Wood '277 in view of Ohno, U.S. Patent No. 4,280,302.

The Examiner's rejections are respectfully traversed.

The claims as now amended are directed to a method of treatment of a rolling element bearing component by hard particle abrasion. The method includes immersing the component in a receptacle containing hard abrasive particles and agitating the bearing components and hard particles to produce relative movement therebetween and to improve the surface topography of the component until a residual compressive stress of between 200MPa and 500MPa is induced in the surface of the component.

It is acknowledged that the process of hard particle abrasion is known as extensively evidenced by the publications. All of the prior art documents discuss methods of hard particle abrasion used to reduce the surface roughness of a product such as a bearing. The process is commonly used in the finishing of bearings in order to alter the surface roughness to a degree which achieves a desired bearing performance. The relationship between the bearing surface roughness and lifespan is well understood and is explained in some detail in the accompanying extract from Kempe's engineer's year book 1997, J1/1949-J1/1950.

As indicated by Kempe's, the degree of surface roughness beneficially influences the lifespan of a bearing but only to a limited extent. Reducing surface roughness beyond a certain

point illustrated as (c) in Kempe's Fig. 2, determined by conventional theory and experiment has no significant benefit and may even reduce the bearing life in part because the reduced surface roughness reduces the ability of the surface to retain lubricant.

The Applicants' invention is not primarily concerned with the reduction of surface roughness of a bearing but the extraordinary discovery that prolonged application of the hard particle abrasion process can be used to raise the residual compressive surface stress in the bearing to between 200MPa and 500MPa. This increased surface stress then results in as much as a twelve fold increase in bearing life versus that of a similar bearing treated conventionally by hard particle abrasion which merely reduces its surface roughness. This is clearly not taught or even suggested in any of the prior art cited references. A bearing manufactured under the conventional methods, by the hard particle abrasion process, will not present a residual surface tension of between 200MPa and 500MPa when tested. Furthermore, it will not have the lifespan of a bearing manufactured according to the Applicants' invention.

One reason that a bearing manufactured according to the present invention has such a surprisingly large lifespan as opposed to the otherwise identical bearings finished conventionally via hard particle abrasion is that residual compressive stress induced in the surface relieves the cyclic tensil stress imposed at the contact point of a bearing surface. The consequence is greatly reduced fatigue in the bearing surface.

Enclosed is a sheet illustrating the Applicants' evidence of the performance of the invention. The graph shows the theoretical increase in bearing life forecast using a conventional mathematical model. Such models are largely empirically derived from data generated by the various organizations involved in bearing development. However, while they may differ in detail, they are generally in agreement that beyond the point where boundary

lubrication is effective, the left hand vertical dotted line in the graph, reductions in surface roughness have very little effect on bearing life and so are not worth the disproportionate increase in effort required to achieve them. As previously explained, the surprising result of the present invention is that by continuing to use a process conventionally well known for the reduction of surface roughness, the same well known apparatus begins to impose a residual compressive stress in the bearing surface. This effect, and not the reduction in surface roughness, has great benefits in increasing the bearing life. This is a totally unexpected result.

In fact, Hashimoto '770 distinctly teaches the person skilled in the art not to implement this process. Hashimoto '770 is concerned with mathematical models of otherwise conventional hard particle finishing processes used to determine just how long it is necessary to expose the product to vibratory hard particle abrasion in order to achieve the required finish in optimal time. If the person skilled in the art follows Hashimoto '770, he would never expose the product for hard particle abrasion for long enough to achieve the specified increase in residual surface compression.

Thus, as independent claim 17 is patently distinguishable from the prior art references, the remaining claims dependent therefrom are also patently distinguishable.

In view of the foregoing, it is believed that the amended claims and the claims dependent there from are in proper form. The Applicants respectfully contend that the teachings of Hashimoto '770 and Wood '277 in view of Ohno '302 do not establish a *prima facie* case of obviousness under the provisions of 35 U.S.C. §103(a). Thus, claims 17-30 are considered to be patently distinguishable over the prior art of record.

The application is now considered to be in condition for allowance, and an early indication of same is earnestly solicited.

Respectfully submitted,

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